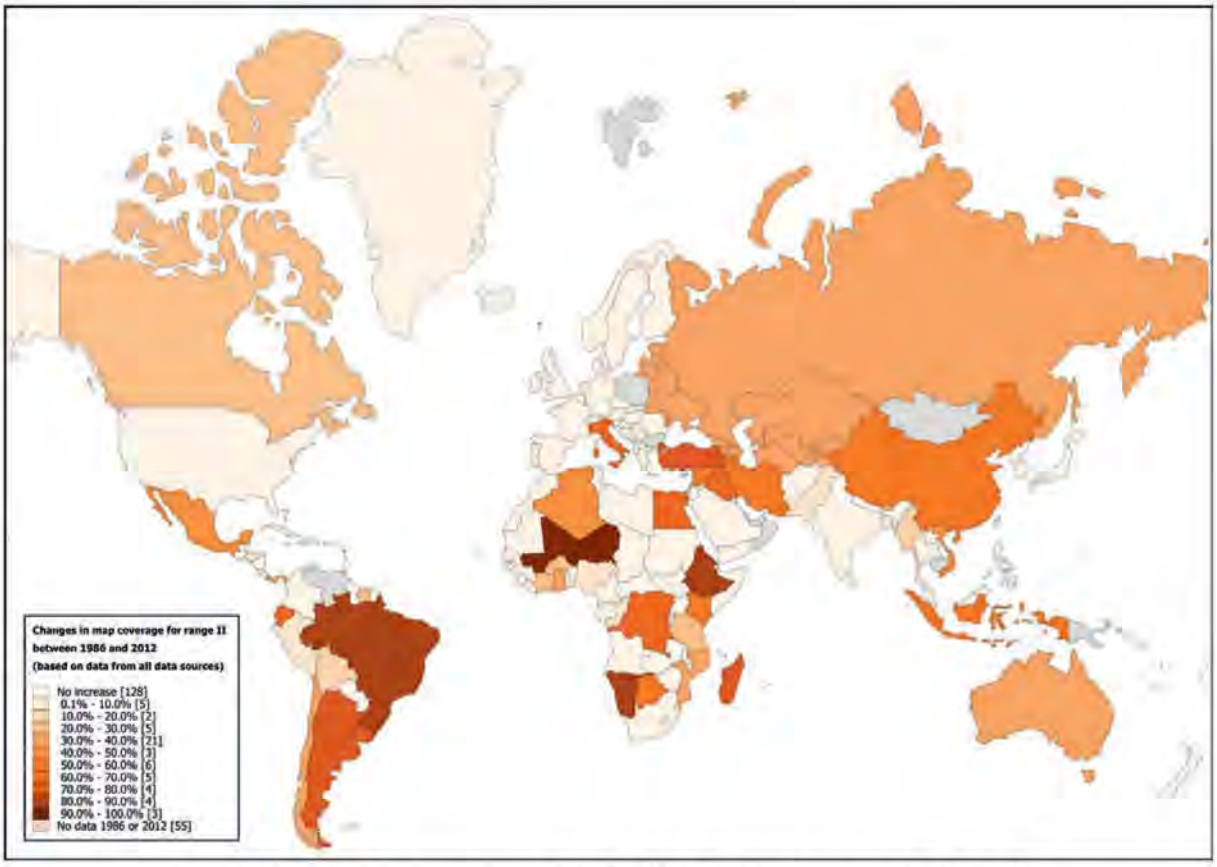

Fig. 14: Change in map coverage between 1986 and 2012 for range II - 1:50,000

This answers question 2 at least in part.

The change map in Fig. 14 indicates where the most relevant changes have occurred between 1986 and 2012: most significantly in Latin America, in Sub-Saharan Africa, but also in China, Mexico, Iran and Turkey, as well as to a somewhat lesser degree in the Russian Federation, in Australia and in Canada.

The other 25 questions characterize the general global infrastructure for provision of map data. Fig. 15 to Fig. 39 give answers to the most relevant questions from 3 to 27 in the listed categories. They are summarized as follows:

1) Restricted access to data: While there are no restrictions in the Americas, in Europe, in most of Africa and in Oceania, restrictions to the data for the public exist in the Russian Federation and in most parts of Asia (e.g. China, Iran, Saudi Arabia). See Fig. 15.
2) Sale of data versus free of charge availability of data: In the Americas data are generally free of charge. They are sold to the public or to governmental users in Europe, Africa, Asia and Australia. See Fig. 16.
3) With the exception of most parts of Europe, South Africa, Iran, Saudi Arabia most other countries use satellite imagery for national data updating. See Fig. 19.
4) Crowd sourcing is only introduced in the USA, France, Spain, Poland and Finland. Fig. 20.
5) While mapping in the Russian Federation, in China, in Mexico and in France is done in-house by the national mapping agencies, in the USA, Canada Brazil, South Africa,

Australia, Japan and Iran mapping is also done by outsourcing or exclusively by outsourcing, like in Saudi Arabia and Namibia. See Fig. 21.

6) Almost all countries use orthoimaging as additional source to supplement mapping. See Fig. 26.
7) Interest in 3D mapping is prevalent in Europe, China, the Russian Federation, Australia and Brazil, while in North America, Scandinavia and South Africa governmental mapping agencies have no direct interest see Fig. 27.
8) National cadastral coverage is lacking in the Americas and in Saudi Arabia. See Fig. 28.
9) With the exception of Great Britain all national mapping agencies are funded by government. See Fig. 33.
10) Few countries have answered budgetary details. But for those, which answered, the funding per area is highest in Britain, France, the Scandinavian countries and in Japan. See Fig. 34.
11) The number of mapping staff per area is highest in China, Japan, Europe, Mexico and Kenya. See Fig. 35.
12) The delivery of map data via web services id practiced in North America, in most of Europe, in China and in South Africa. See Fig. 37.

Fig. 15: Question 3. Restricted access or limited circulation to maps and/or data

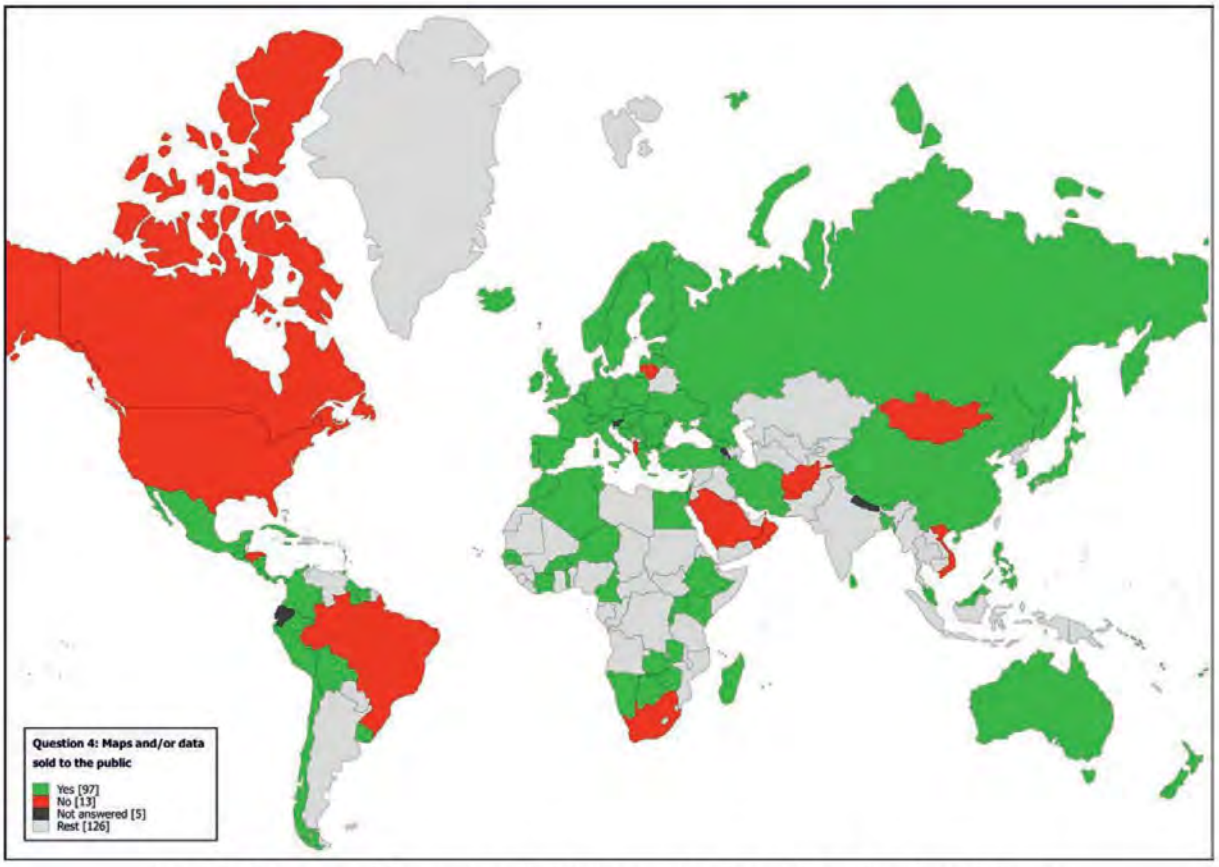

Fig. 16: Question 4. Maps and/or digital data sold to the public or data free of charge

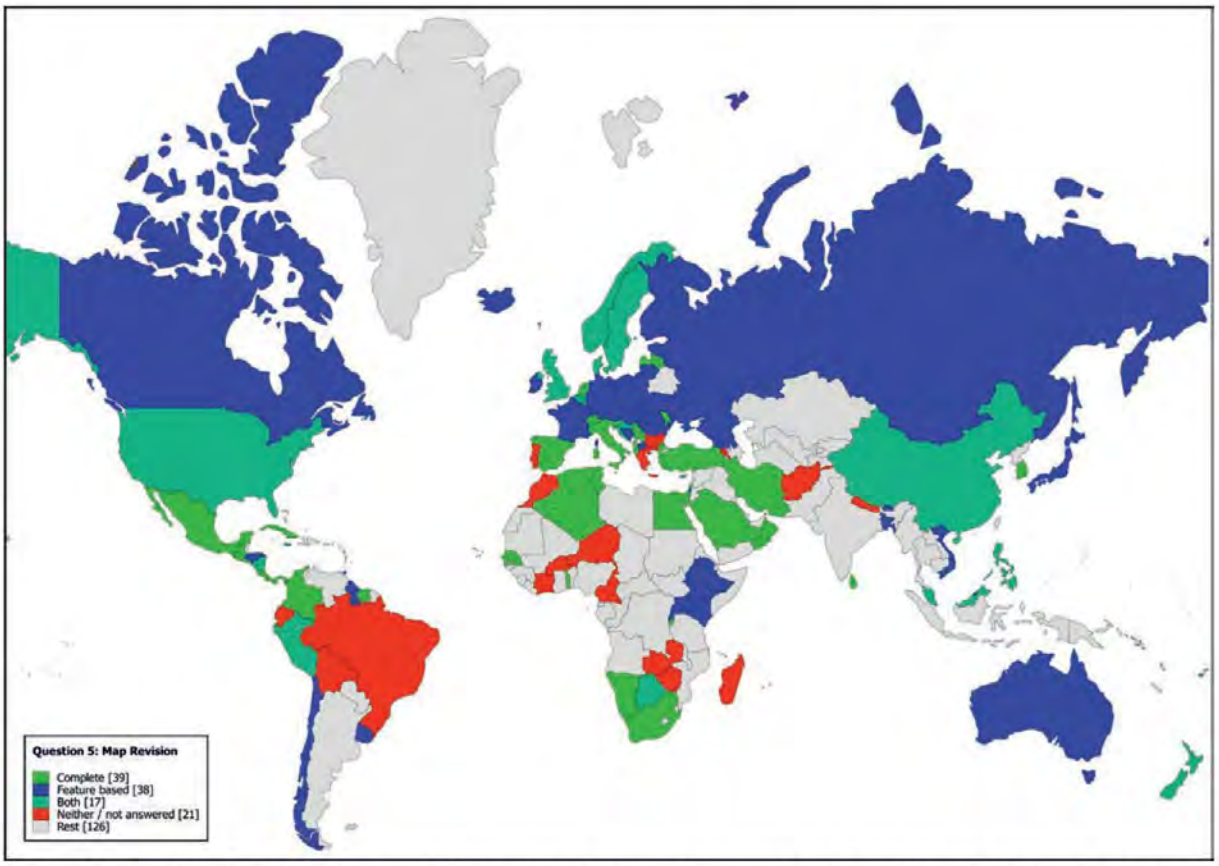

Fig. 17: Question 5. Cycle of map and data revision by complete mapping, ie. revision of a national series or mapping of changed features

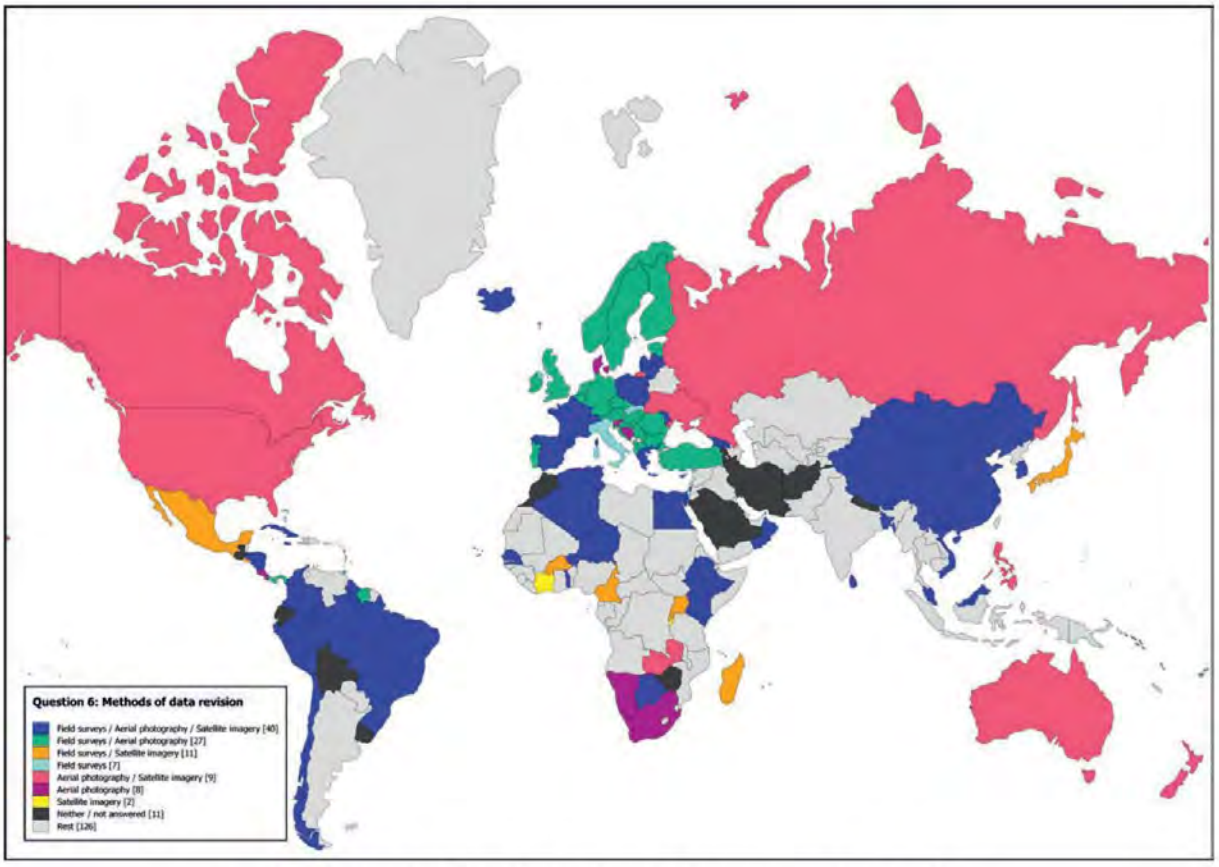

Fig. 18: Question 6. Methods of national data revision and map updating

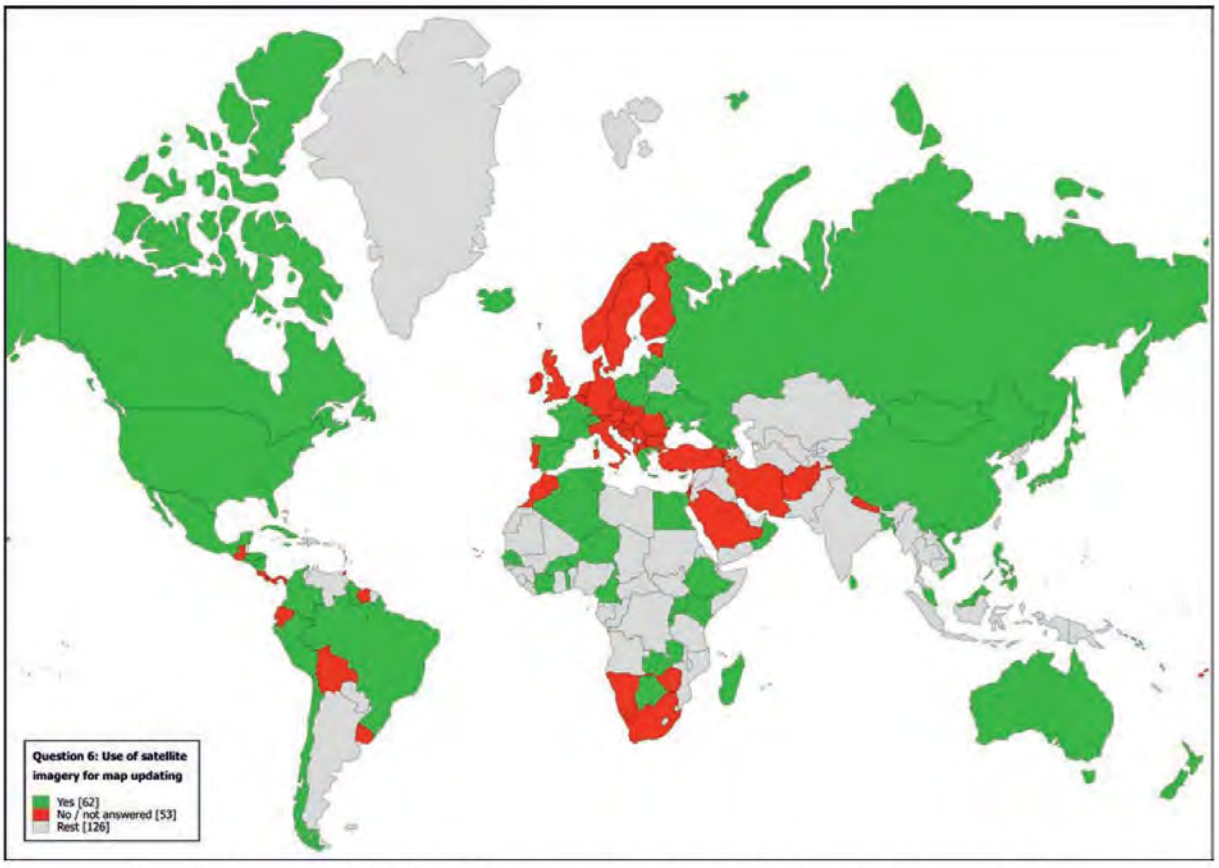

Fig. 19: Question 6. Use of satellite imagery for national data revision and map updating

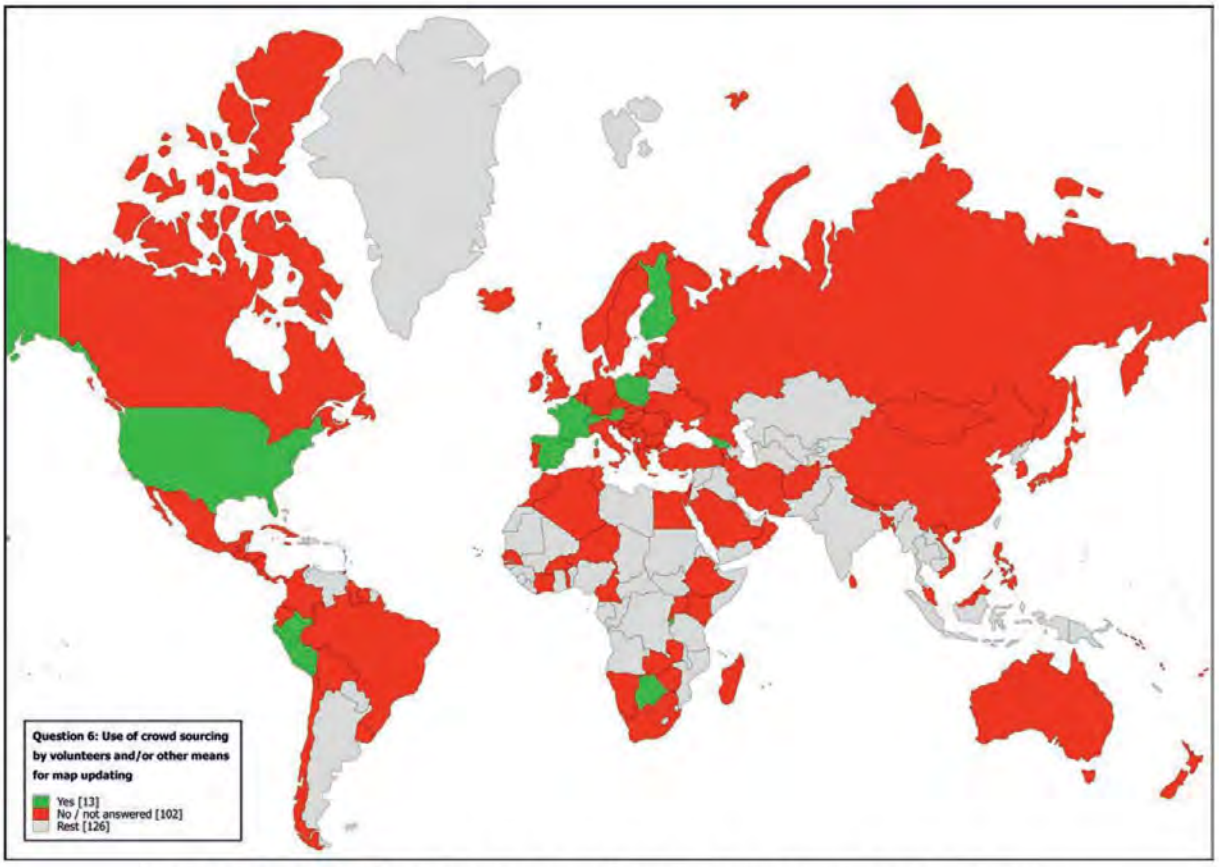

Fig. 20: Question 6. Use of crowd sourcing for national data revision and map updating

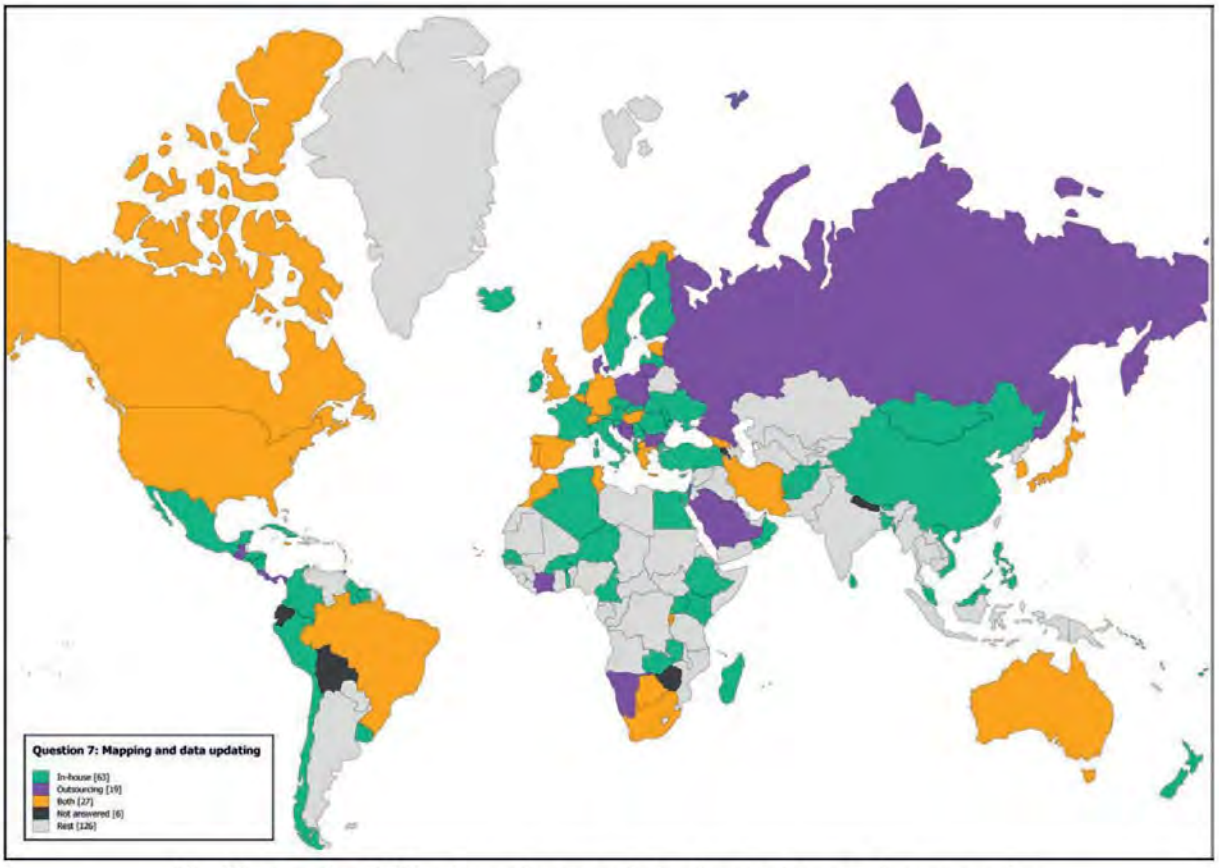

Fig. 21: Question 7. Mapping and map updating done in-house or by outsourcing

Fig. 22: Question 8: National aerial photography acquisition program

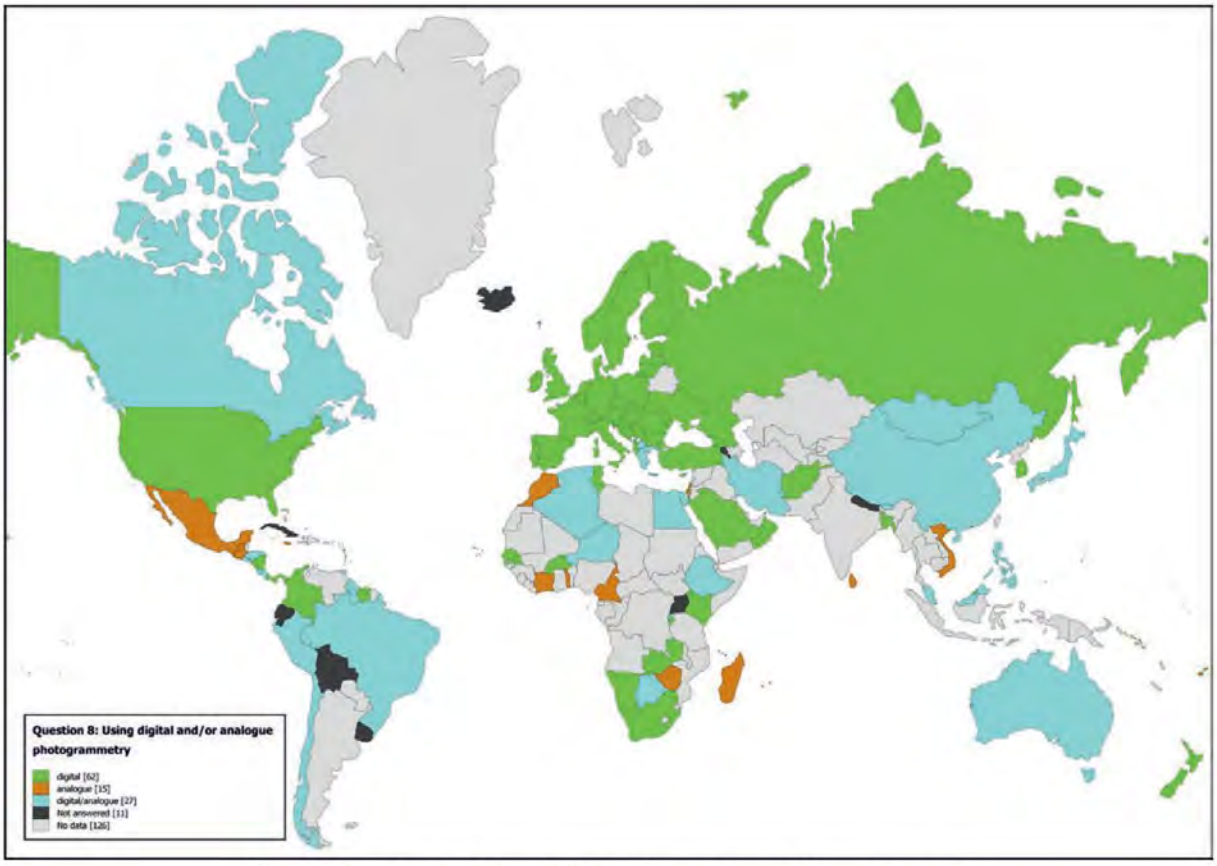

Fig. 23: Question 8. Using digital and/or analogue photogrammetry

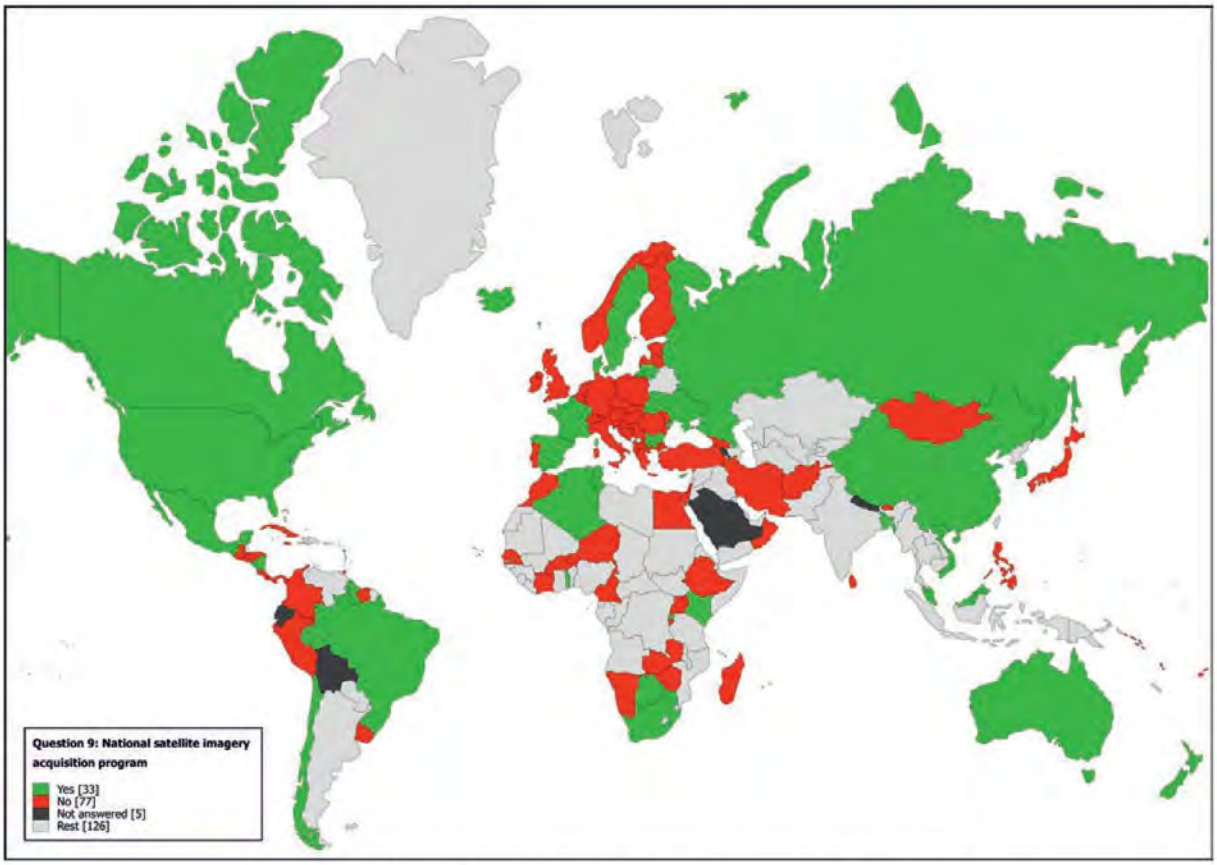

Fig. 24: Question 9: National satellite imagery acquisition program

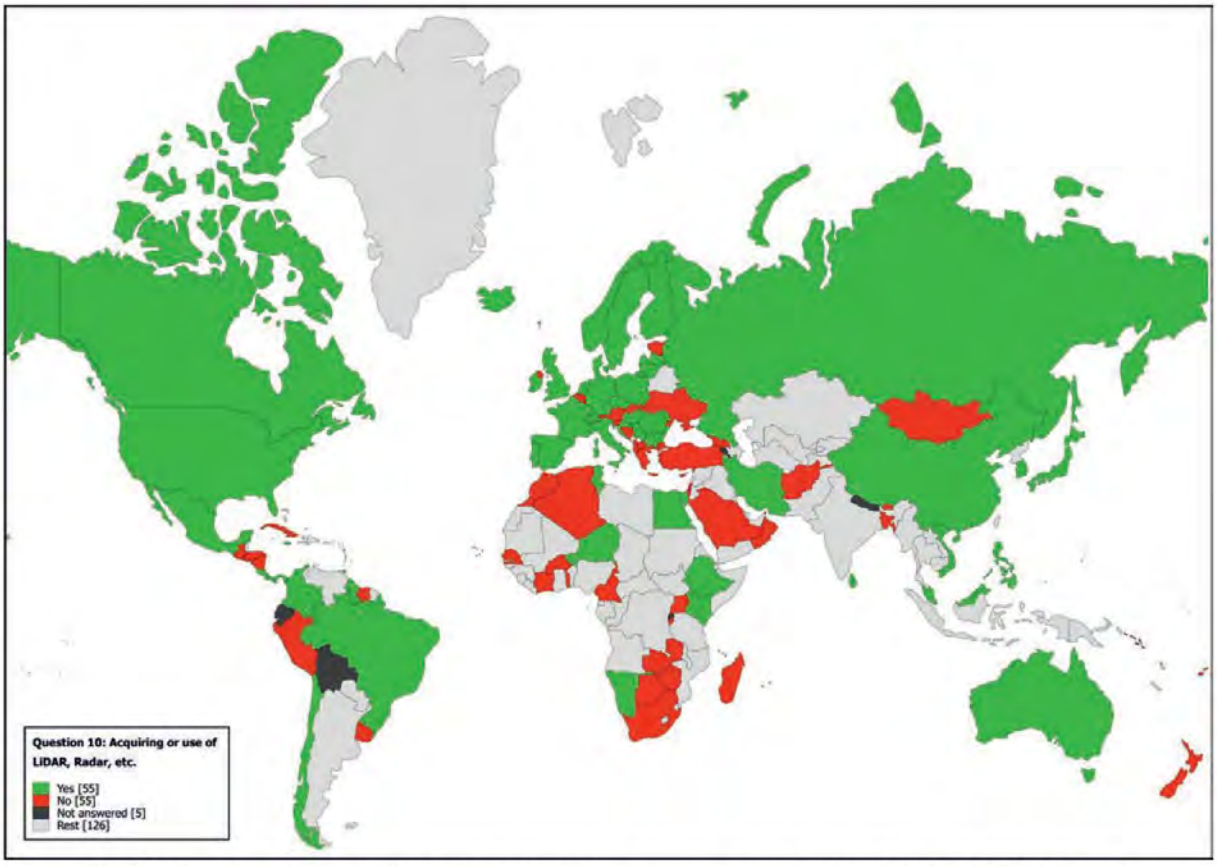

Fig. 25: Question 10. Acquiring and/or using other imagery types (such as LiDAR, RADAR, etc.)

Fig. 26: Question 12. Production of orthophotos and orthophotomaps

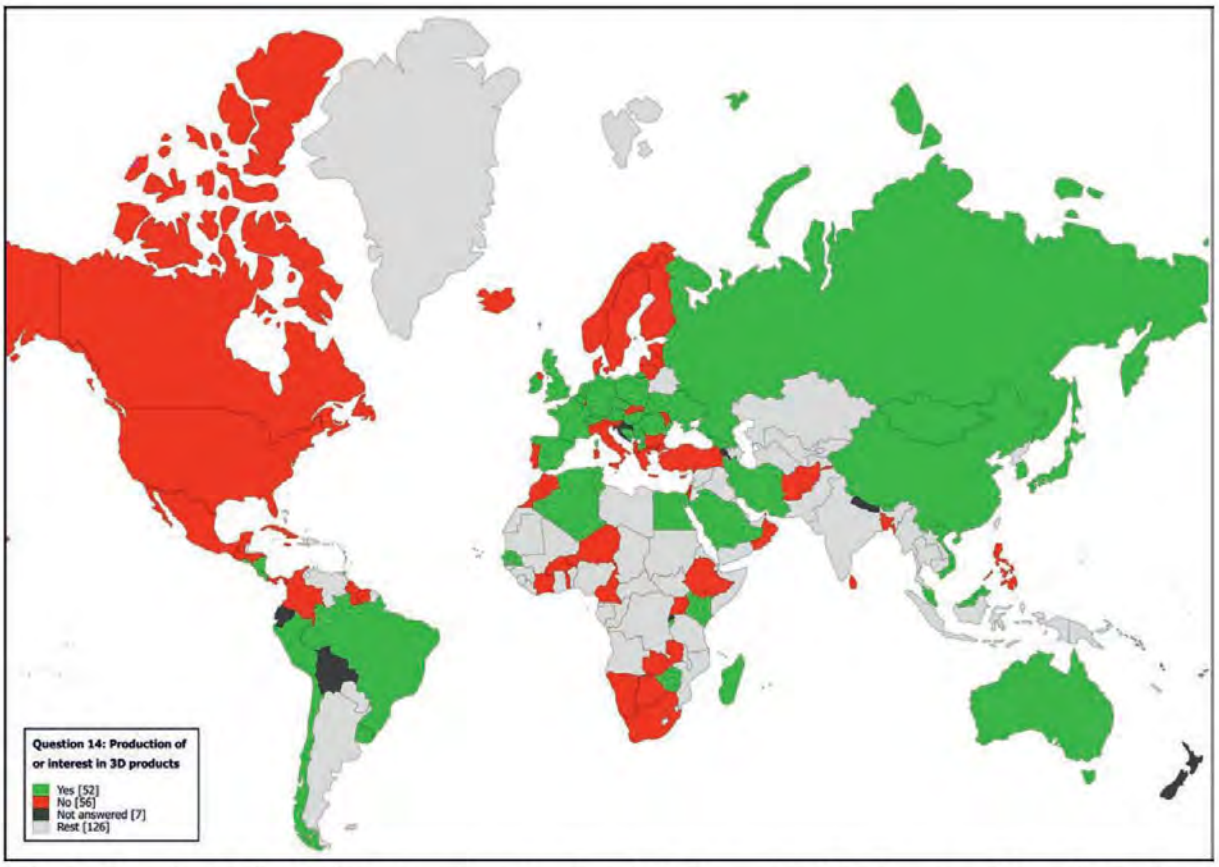

Fig. 27: Question 14. Production or intention to produce, 3D urban and rural landscape models and/or product visualization

Fig. 28: Question 16. National coverage of cadastral maps and/or data available

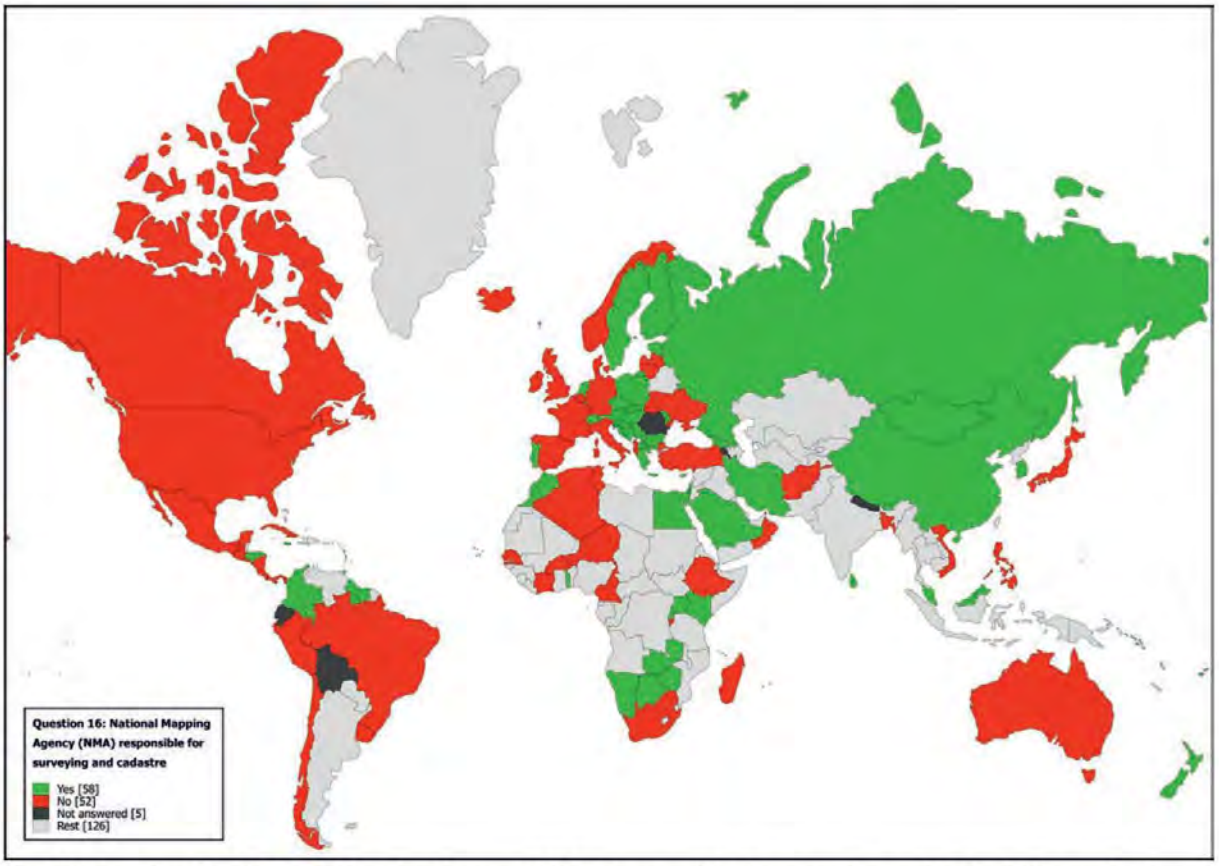

Fig. 29: Question 16. National Mapping Agency (NMA) responsible for surveying and/or land titles and cadastre

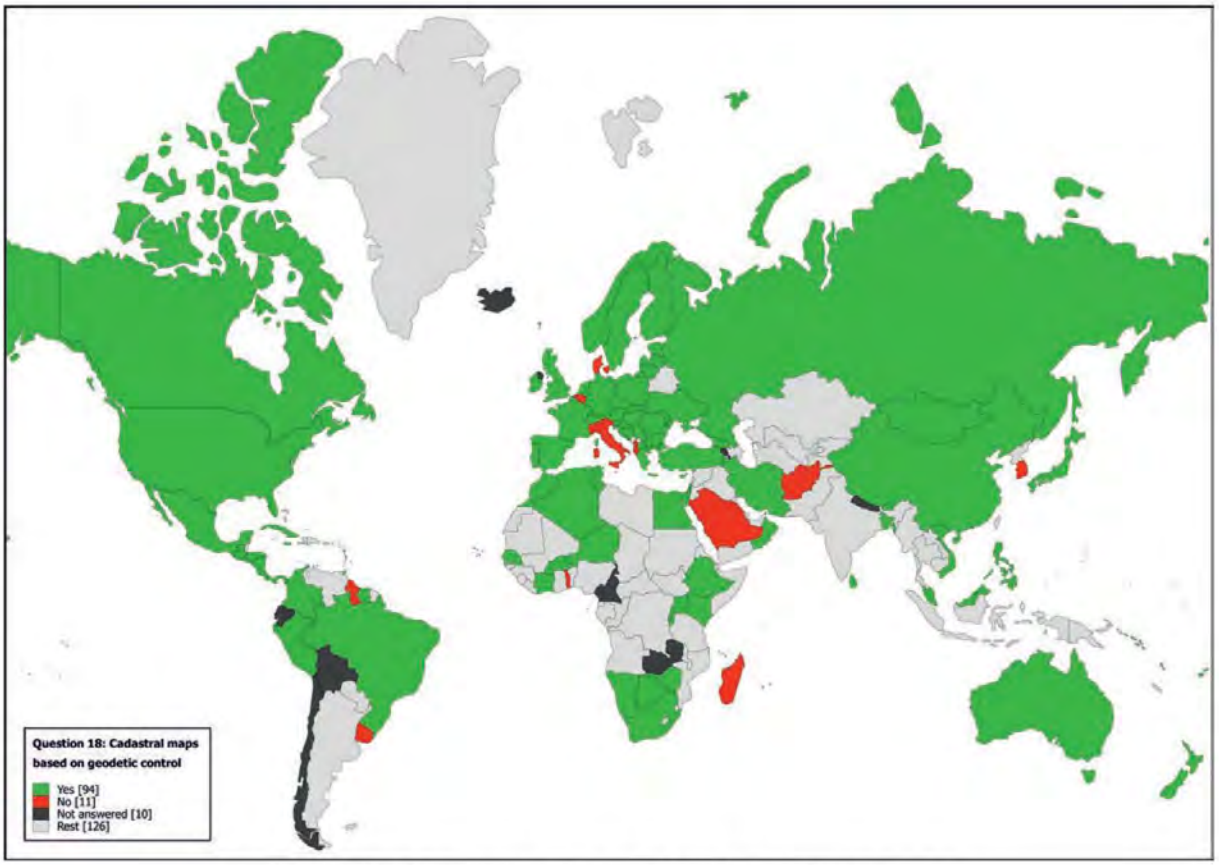

Fig. 30: Question 18. Cadastral maps based on geodetic control

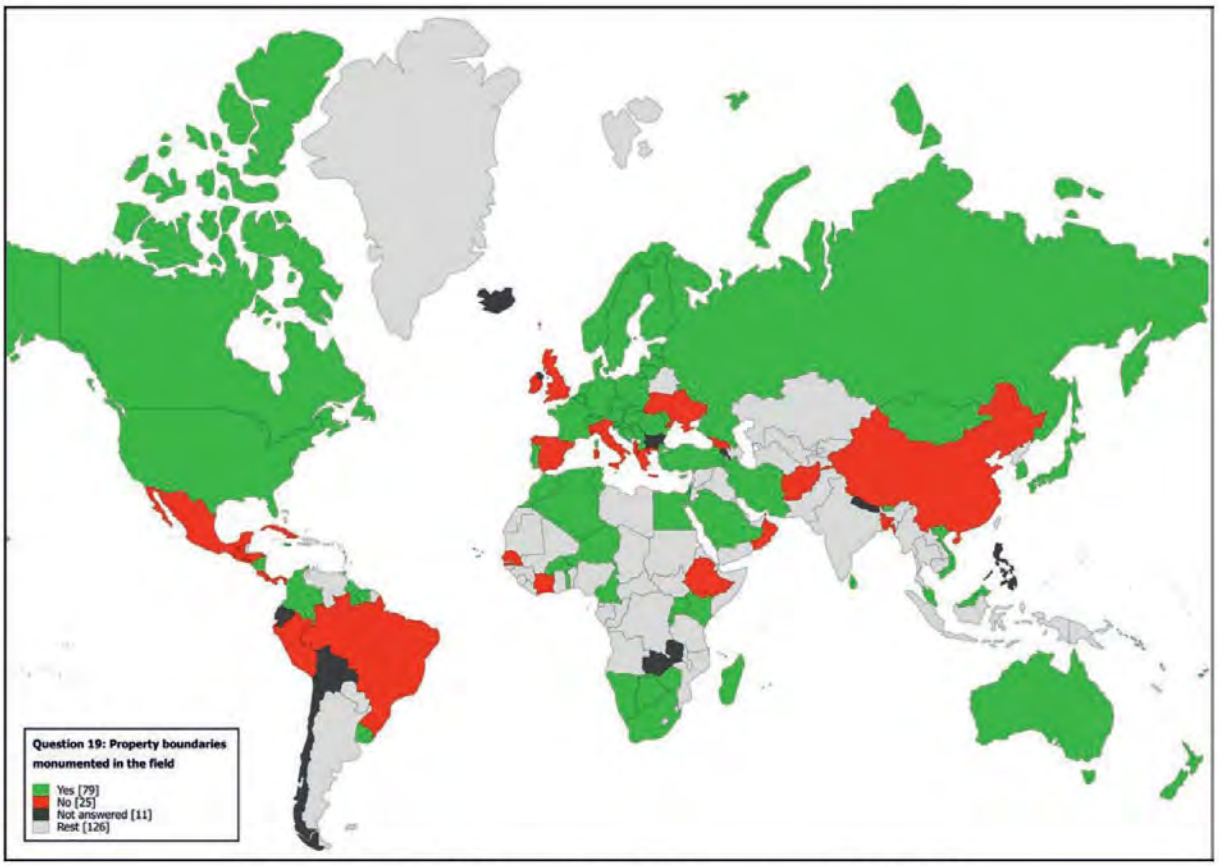

Fig. 31: Question 19. Property boundaries monumented in the field

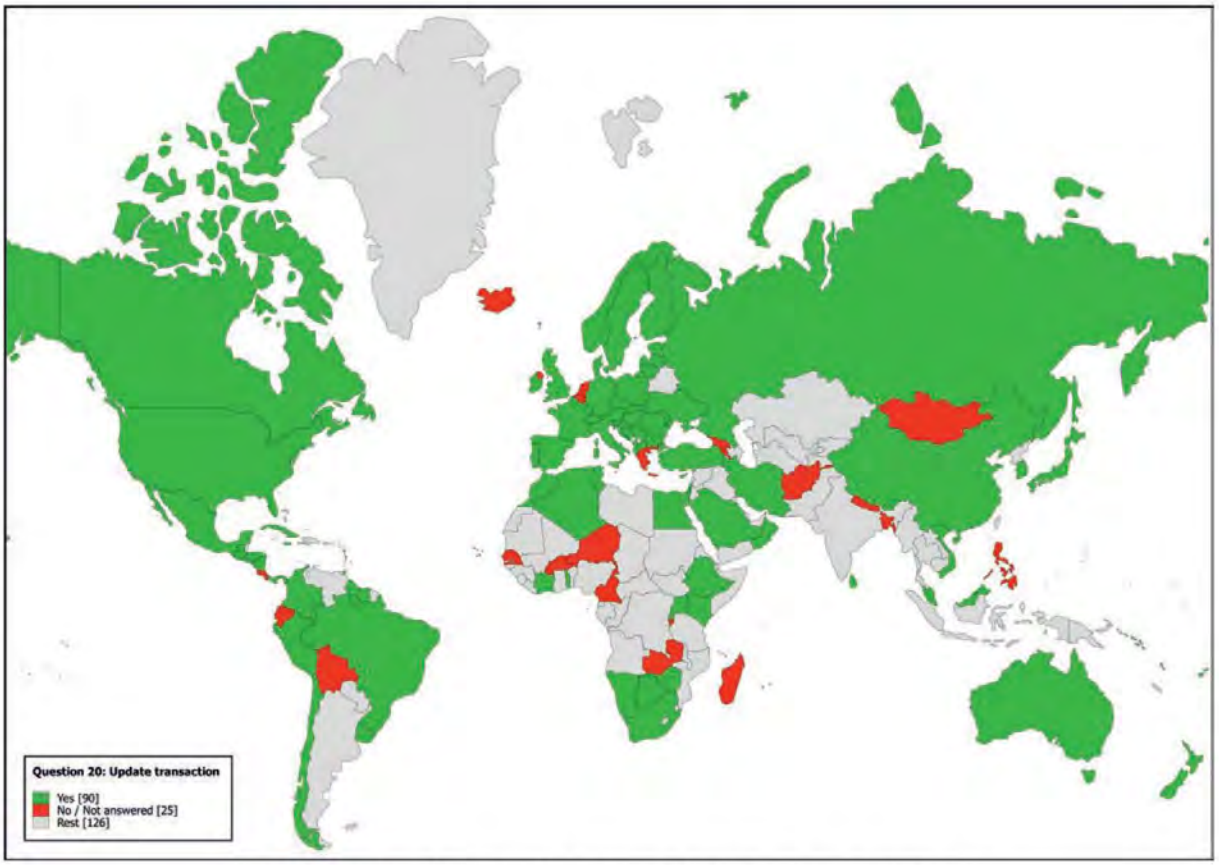

Fig. 32: Question 20. Update transaction of property maps and/or data

Fig. 33: Question 22. National topographic mapping, imagery acquisition, surveying and cadastral programs funded by your national Government

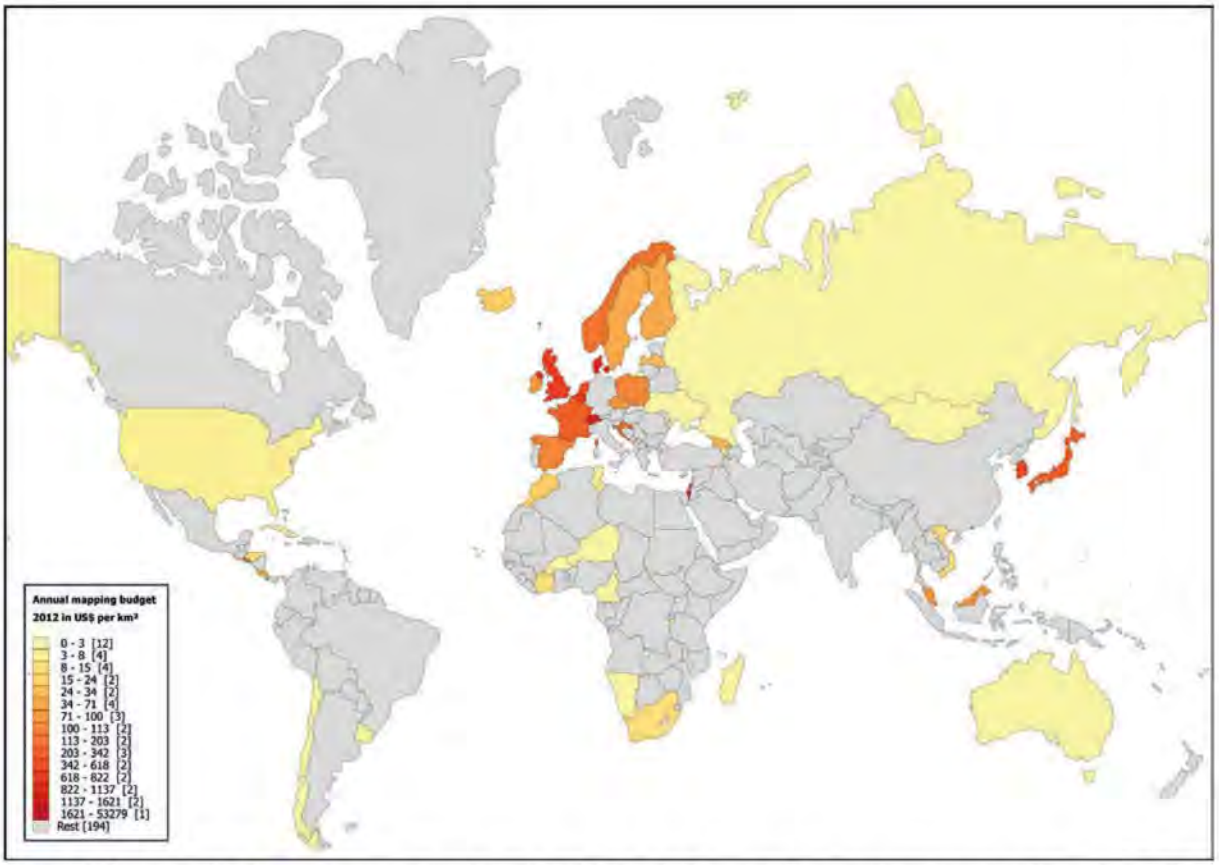

Fig. 34: Question 23. Annual mapping budget of the National Mapping Organization converted to million US$ per square kilometer of the country area

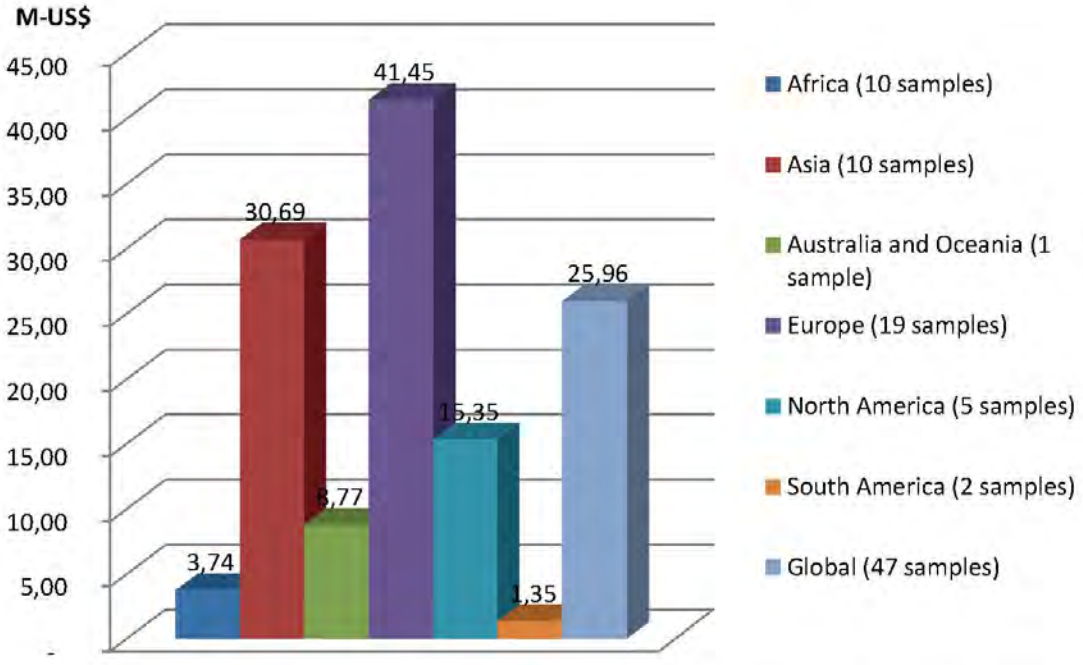

Chart 5: Question 23. Average annual budget 2012 per region converted to million-US$

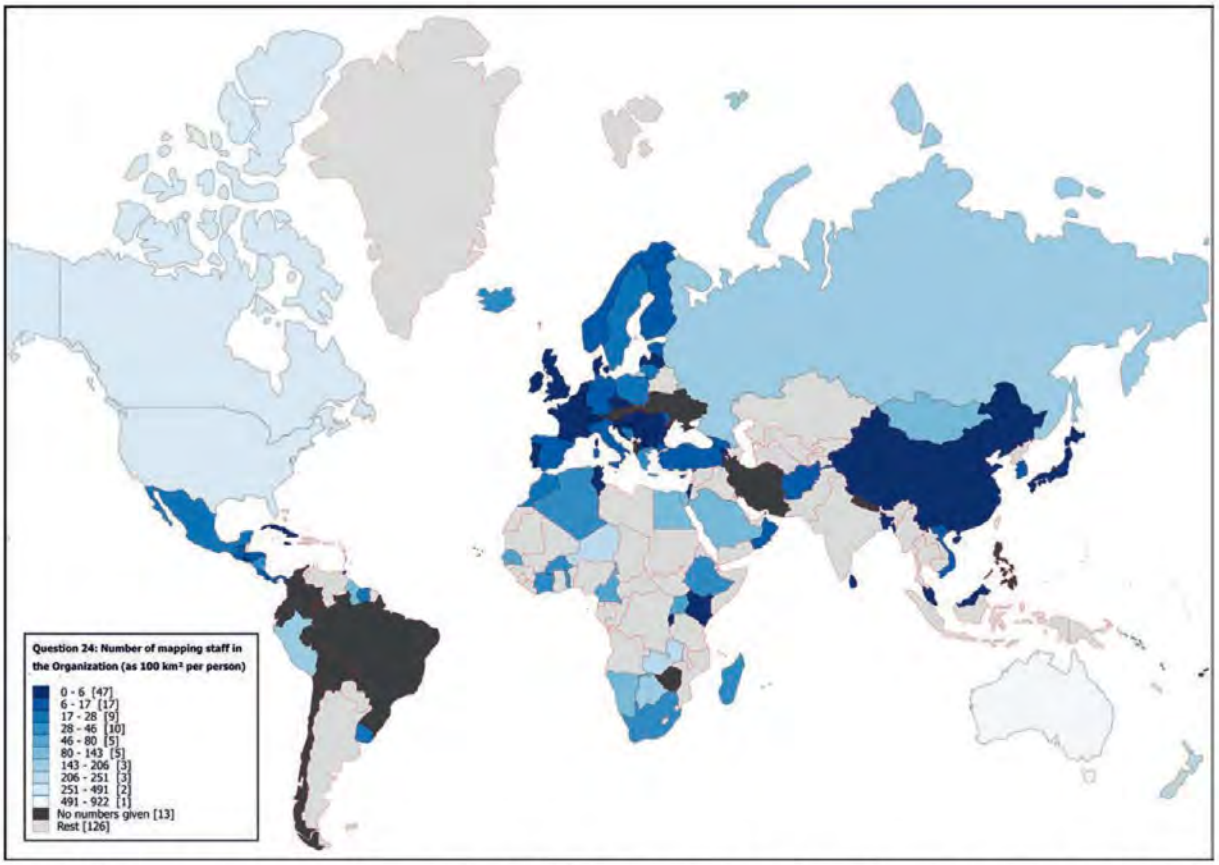

Fig. 35: Question 24. Number of mapping staff in the Organization as hundreds of square kilometers of country area per person

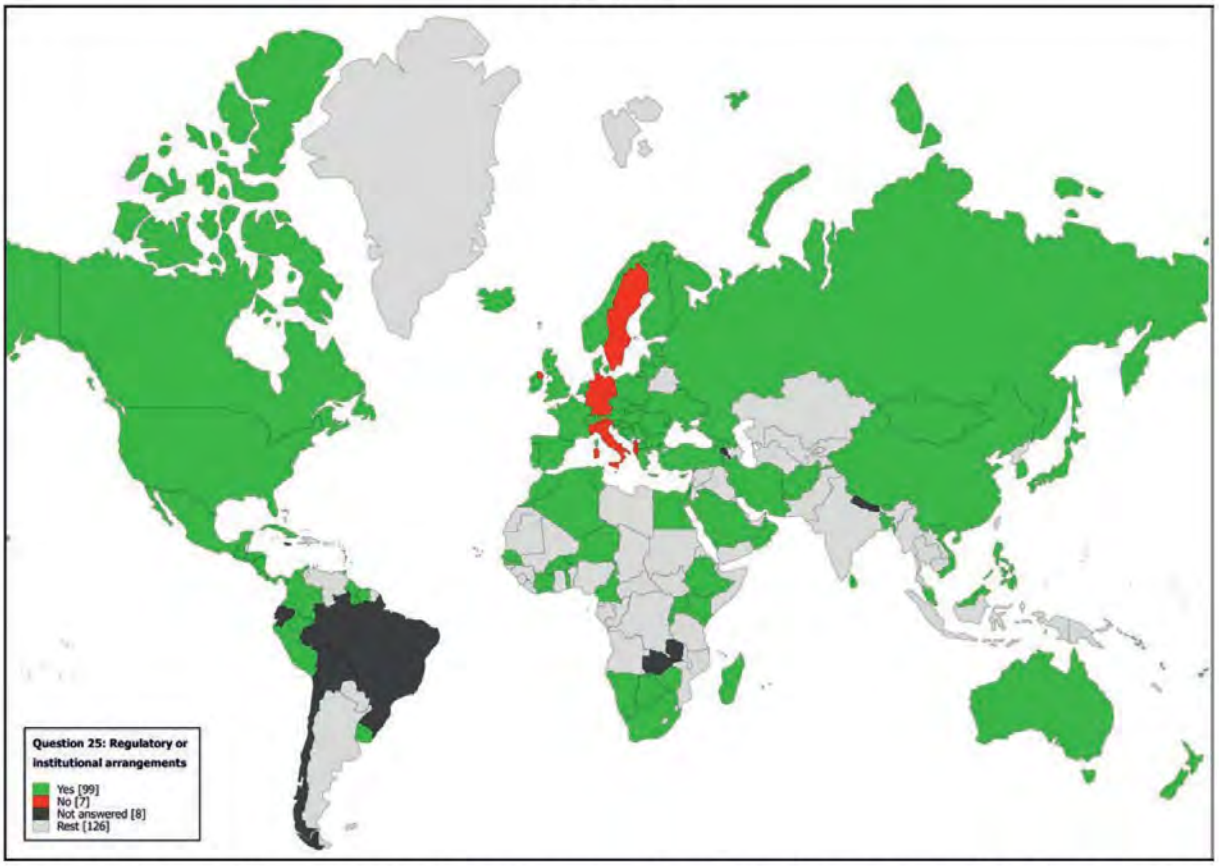

Fig. 36: Question 25. Regulatory or institutional arrangements mandating the organization to fulfil its role as the lead mapping agency

Fig. 37: Question 26. Delivery of different map and data products via web services

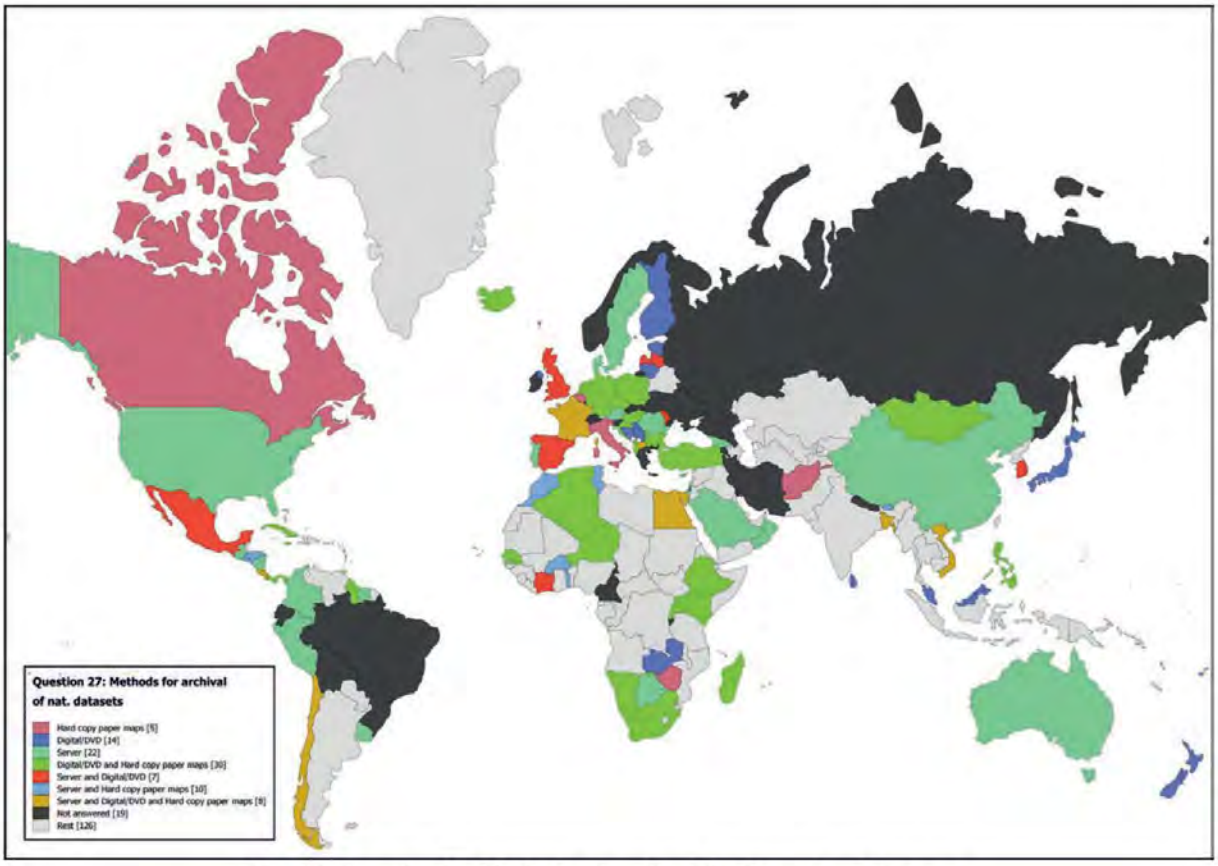

Fig. 38: Question 27. Methods of archival for the national data sets

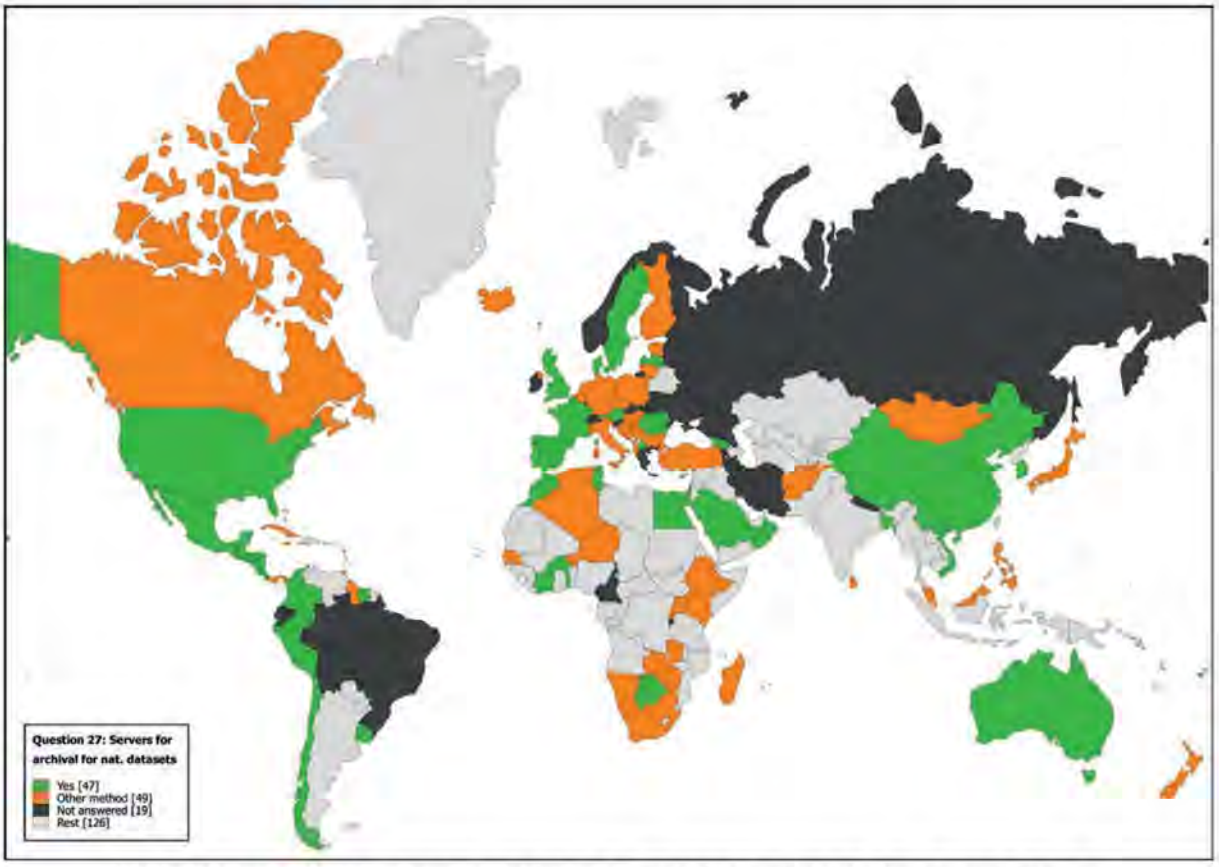

Fig. 39: Question 27. Using servers/databases as method of archival for the national data sets

5 Mapping Contributions by Private Industry

As has been demonstrated, official and authoritative mapping by governments provides a reliable geospatial infrastructure, which is used for many public and private applications, but which is costly, difficult and slow to maintain. For that reason private enterprises have succeeded to launch several initiatives to provide faster update solutions in areas, which require fast update solutions. These are based on different cost and accuracy models for specific applications, which require fast updates. These applications do not replace official authoritative cartography, but they supplement it, as all such efforts utilize official cartographic products as a base to start their value added operations.

5.1 Google

Google´s prime aim is to provide a location based information system for uses of the public. What the general user wants is quick orientation about how to locate a specific object, such as a landmark, a store, a restaurant or a service provider and how to drive to it.

Geometric accuracy within the context of the neighborhood topography is of lesser importance than the addressability and the access by roads or pathways. In general, business advertising provides for the revenue to establish and to maintain the system.

Google Inc. operates by different projects, of which the following are the most important from the cartographic point of view.

5.1.1 Google Earth

Existing orthophotography coverage with ground sample distances between 0.1m and 0.5m as well as high resolution satellite imagery overages with ground sample distances (GSD) between 0.5m to 2m and beyond provide the geometric background image information, which can be interpreted by the user with respect to the searched objects, such as buildings, roads, vegetation, water surfaces. While ortho images have a high geometric accuracy related to ground features commensurate with the GSD, this is not so for building tops and tree tops. Geometric accuracy even deteriorates more for high resolution satellite imagery, since most of these images have been acquired with inclinations with respect to the vertical, unless stereo imaging permitted the generation of ortho imagery. The coverage is global for all land areas.

Nevertheless, despite some of these shortcomings with respect to official cartography, Google Earth can easily satisfy the geolocation demands for the uses Google Earth has been designed for.

5.1.2 Google Maps

Google Maps is a product usually derived, wherever possible, from authoritative cartography. It has been designed to supplement Google Earth with a cartographic output containing place names, road names and building addresses. It serves the ideal function of superimposing images with line graphics. Even though Google Maps may be derived from authoritative cartography, the feature content is much less elaborate and reduced to the intended geolocation function. The 3 models for creating Google Maps are shown in Fig. 40: a) relying on authoritative data in North America, Europe, Australia as "Google Ground Truth", b) Map Maker outsourced, leaving the initiative of mapping using Google Earth to other companies (Africa, Middle East, India) and c) "Video Rental" model offering Google Earth imagery to other countries for mapping use (Russia, China).

Fig. 40: Google Maps

5.1.3 Google Street Map

Google Street Map has been developed as a tool to image buildings and streets with street furniture along urban roadways. This is done by vehicle based cameras, located by GNSS